

Four New Species and a New Genus of Opisthobranch Gastropods from the Pacific Coast of North America

by

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Abstract. This paper describes four new species of opisthobranchs from the eastern Pacific. *Runcina macfarlandi* is described from Oregon and may also be known as far south as Monterey Bay, California. *Baptodoris mimetica* is known from Monterey Bay, south to Isla San Martín, Baja California. This represents the first record of the genus from eastern Pacific waters. *Noumeaella rubrofasciata* is described from southern California south to Islas San Benitos, Baja California. *Anetarca* gen. nov., with type species *A. armata*, is described from the Pacific coast of central Baja California.

INTRODUCTION

The opisthobranch fauna of the Pacific coast of North America has been well studied (MACFARLAND, 1966; BEHRENS, 1980; McDONALD & NYBAKKEN, 1980; McDONALD, 1983). Despite the fact that the fauna has been extensively surveyed, additional species continue to be described (MILLEN, 1986, 1987; GOSLINER & BEHRENS, 1986; BEHRENS, 1987; BEHRENS & GOSLINER, 1988a, b; GOSLINER & BERTSCH, 1988). Additional recent collections continue to yield undescribed species. This paper describes four additional species of opisthobranchs from the eastern Pacific. All four of these species are placed in genera that have no previously described representatives recorded from the eastern Pacific. The systematic relationships and biogeographical affinities of these species are discussed.

SPECIES DESCRIPTIONS

Order Cephalaspidea

Family RUNCINIDAE H. & A. Adams, 1854

Genus *Runcina* Forbes & Hanley, 1853

Runcina macfarlandi Gosliner, sp. nov.

(Figures 1A, 2, 3)

Type material: Holotype, California Academy of Sciences, San Francisco, CASIZ 074572, found on submerged tips of *Cladophora trichotoma* (C. A. Agardh) Kützing, in

high intertidal pools, Seal Rock State Park, Seal Rock, Lincoln County, Oregon, 9 July 1990, Cynthia Trowbridge. Paratype, dissected, CASIZ 074573, same date and locality as holotype. Paratype, CASIZ 074574, dissected, same locality as holotype, 20 June 1990, Cynthia Trowbridge.

Distribution: *Runcina macfarlandi* has been collected from two localities within Lincoln County Oregon (Cynthia Trowbridge, personal communication), Boiler Bay State Park, north of Depoe Bay, south to Seal Beach State Park, near Seal Beach. This species probably has also been collected from the central California coast (see Discussion).

Etymology: This species is named for the late Frank Mace MacFarland, who pioneered studies of eastern Pacific opisthobranchs. He also first illustrated a specimen of a species of *Runcina* collected from Pacific Grove in 1899. In all probability this is the species described here.

External morphology: Living animals (Figures 1A, 2A) are 3–5 mm in length. The notum is yellowish brown with darker brown to black pigment in the central portion of the body. The head shield is flattened anteriorly and widens into the broad ovoid body. Posteriorly the ctenidium consists of two simple, rounded plicae, which are well separated from each other. The eyes are visible along the anterolateral sides of the body, between the notum and the foot. A sperm groove traverses the right side of the body from the hermaphroditic gonopore near the posterior end to the penial aperture on the anterolateral end of the body.

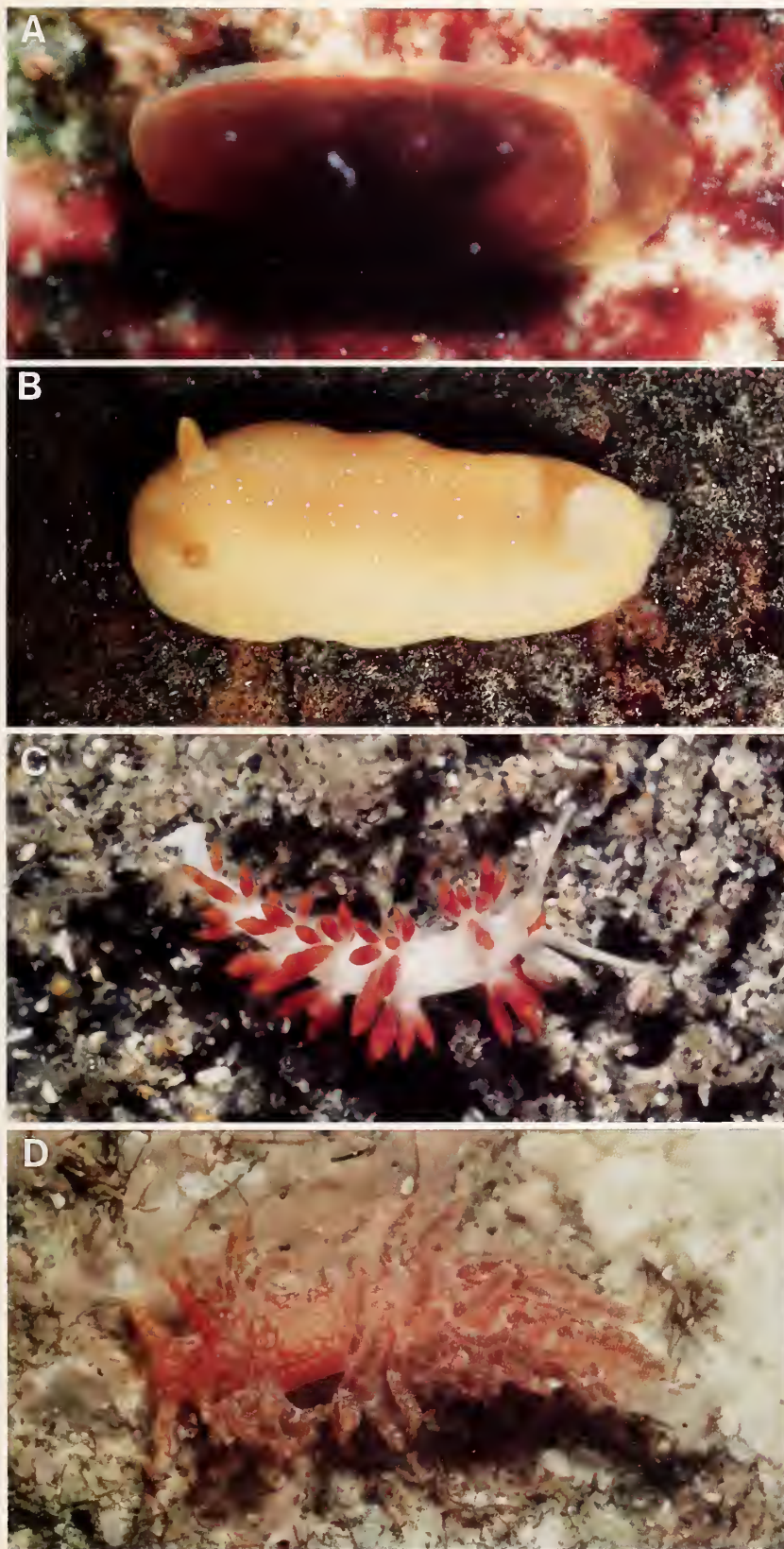


Figure 1

Living animals. A. *Runcina macfarlandi* sp. nov. B. *Baptodoris mimetica* sp. nov. C. *Noumeaella rubrofasciata* sp. nov. D. *Anetarca armata* gen. et sp. nov.

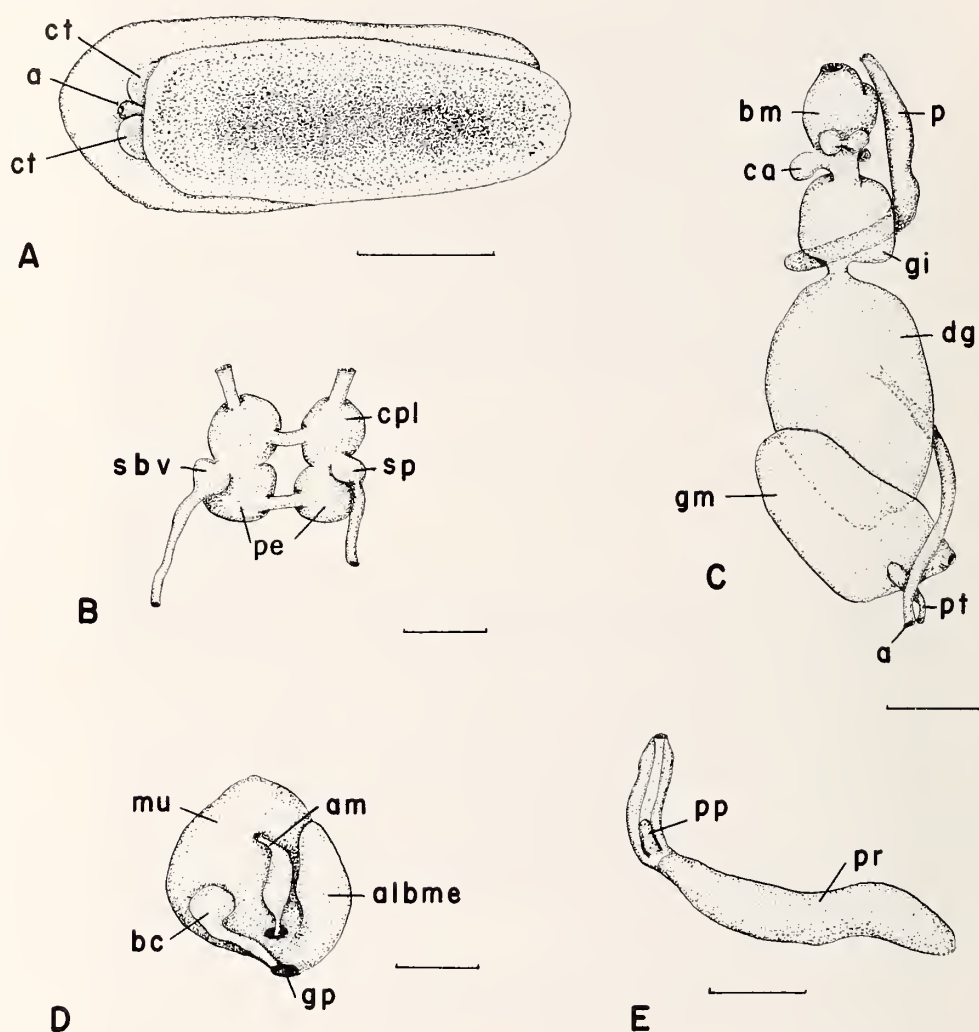


Figure 2

Runcina macfarlandi sp. nov. A. Dorsal view of living animal: a, anus; ct, ctenidium; scale = 1 mm. B. Central nervous system: cpl, cerebral pleural ganglion; pe, pedal ganglia; sbv, subintestinal-visceral ganglion; sp, suprainsintestinal ganglion; scale = 0.25 mm. C. Digestive tract: a, anus; bm, buccal mass; ca, caecum; dg, digestive gland; gi, gizzard; gm, genital mass; p, penis; pt, ptyaline gland; scale = 0.5 mm. D. Reproductive system: albme, albumen-membrane glands; am, ampulla; bc, bursa copulatrix; gp, genital pore; mu, mucous gland; scale = 0.25 mm. E. Penis: pp, penial papilla; pr, prostate; scale = 0.25 mm.

Digestive tract (Figure 2C): The buccal mass is short and muscular. Within the mass, near its anterior end is a thin labial cuticle that had no obvious chitinous jaw rodlets. More posterior is the radula (Figure 3A) with a formula of $19-21 \times 1 \cdot 1 \cdot 1 \cdot$, in two specimens examined. The rachidian teeth (Figure 3B) are broad, with a pair of elongate, posteriorly directed limbs. The masticatory edge contains a pair of rounded, denticulate pads on either side of the small central denticle. Each of these rounded cutting surfaces bears 5-11 elongate denticles. The lateral teeth (Figure 3C) are elongate and curved. The masticatory border is entirely smooth, without any trace of denticles.

Posterior to the buccal mass, the esophagus narrows and contains a large, saccate caecum. The posterior end of the esophagus enters the muscular gizzard. The gizzard is larger than the buccal mass. Four longitudinally directed gizzard plates are contained within the gizzard. Each chitinous plate (Figure 3D) contains 6 or 7 denticulate transverse ridges.

Posteriorly, the gizzard is connected to the large, lobate digestive gland. From the digestive gland, a narrow intestine emerges and empties into the anus at the posteromedial end of the body. A simple ptyaline gland is present adjacent to the intestine and exits into the anus.

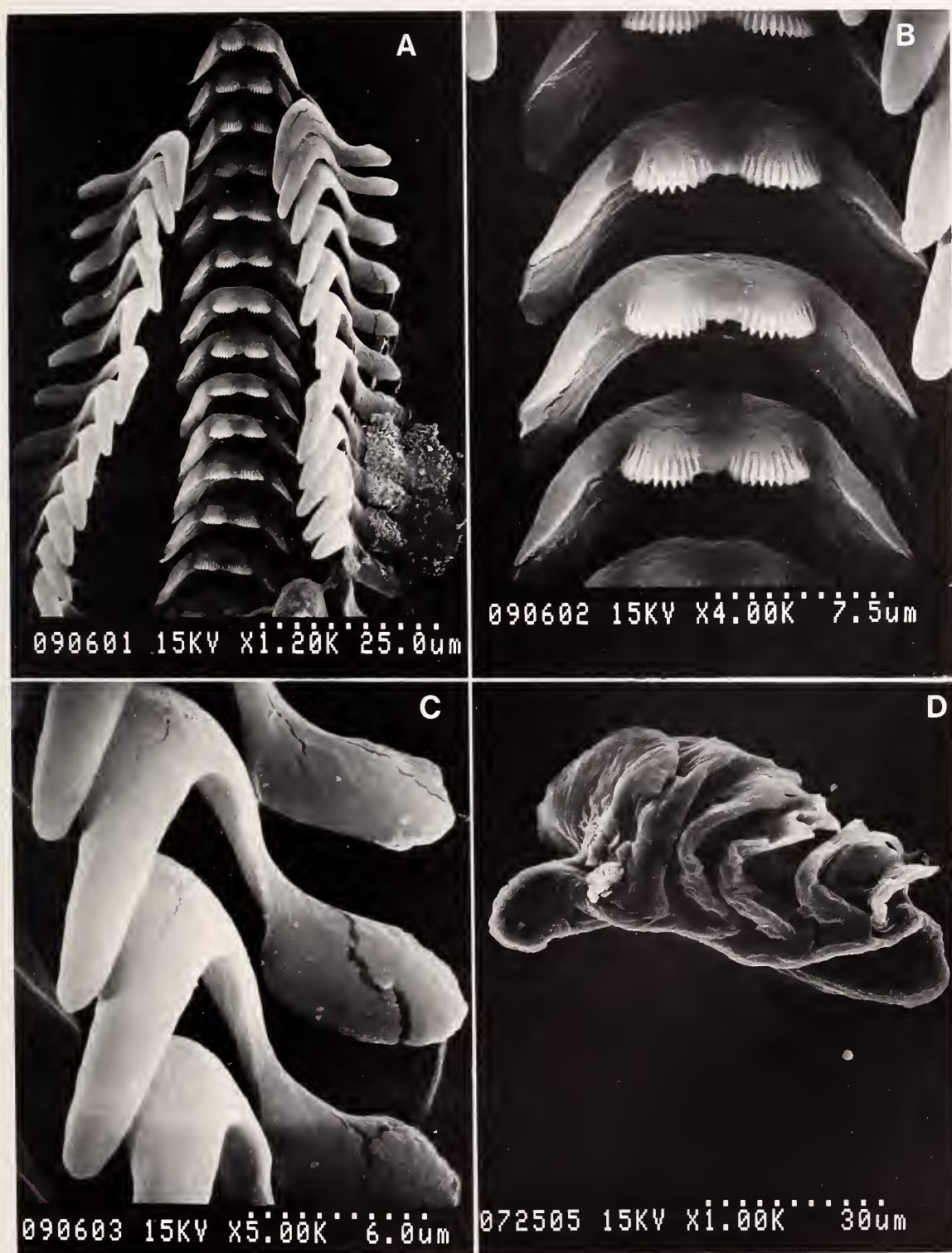


Figure 3

Runcina macfarlandi sp. nov. Scanning electron micrographs. A. Entire width of radula. B. Rachidian teeth. C. Lateral teeth. D. Gizzard plate.

Table 1
Morphological variation in the Runcinidae.

Genus	Shell	Gill	Radular formula	Rachidian	Laterals	Gizzard
<i>Runcina</i> Forbes, 1851	present or absent	2 or 3, right side	1.1.1.	denticulate	denticulate or smooth	present
<i>Ildica</i> Bergh, 1889	present, external	plicate, right side	1.1.1.	smooth	smooth	present
<i>Metaruncina</i> Baba, 1967	present	plicate, right side	reduced	reduced	reduced	present
<i>Runnica</i> Miller & Rudman, 1968	present	plicate, right side	1.1.1	denticulate	short, smooth	present
<i>Runcinella</i> Odhner, 1924	absent	5 circular plicae	2.1.2.	denticulate	outers bifid	present
<i>Runcinida</i> Burn, 1963	absent	5 linear plicae	1.1.1.	denticulate	smooth	present
<i>Ilbia</i> Burn, 1963	absent	absent	1.1.1.	trifid	denticulate	absent
<i>Pseudoilbia</i> Miller & Rudman, 1968	absent	absent	2.0.2.	absent	unequal, denticulate	absent
<i>Lapinura</i> Marcus & Marcus, 1970	present, external	plicate, right side	1.1.1.	denticulate	smooth	present

Central nervous system (Figure 2B): The central system surrounds the esophagus, posterior to the buccal mass. The highly cephalized system is formed of four distinct ganglia. A pair of large cerebral ganglia are separated by a short cerebral commissure. The paired pedal ganglia are situated below the esophagus and are separated from each other by a short commissure. On the left side of the nerve ring is a smaller ganglion representing the fusion of the left pleural and suprainestinal ganglia. On the right side, the right pleural ganglion, suprainestinal, and visceral ganglia have fused to form another small ganglion. No distinct visceral loop was observed.

Reproductive system (Figure 2D): The reproductive system is monaulic. The short saccate ampulla narrows and enters the female gland mass between the mucous and albumen glands. The female glands exist at the gonopore adjacent to the duct of the spherical bursa copulatrix.

The penis (Figure 2E) is thin and elongate. The posterior end curves under the ventral surface of the gizzard. The posterior three-fourths of the penis is composed of the indistinct prostate and spermatid bulb. The penis proper consists of a simple, poorly developed papilla, which is devoid of any armature.

Discussion: The Runcinidae have been subdivided into as many as nine genera by various authors (Table 1). These genera are separated largely on the basis of differences in the arrangement and structure of the ctenidium, formula and shape of the radular teeth, and presence or absence of a shell and gizzard plates. Other than *Runcina*, all other genera contain only a single species. CLARK (1984) considers *Lapinura* Er. Marcus & Ev. Marcus, 1970, as a junior synonym of *Runcina*. THOMPSON & BRODIE (1988) considered *Runnica* Miller & Rudman, 1968, to be a junior synonym of *Runcina*. Based on this synonymy, they considered *Runcina* to include 14 nominal species. GOSLINER (1990) discussed problems related to the systematics of eastern Atlantic species of *Runcina* and suggested possibly synonyms. Certainly, more extensive study of the Runcinidae is required to determine the range of variability of genera and their phylogenetic relationships.

Among described runcinids, *Runcina macfarlandi* is the only species known to possess a single flattened branchial plica on either side of the anus. In other aspects of its anatomy, it does not differ markedly from other species currently placed in the genus *Runcina*. Rather than erect yet another monotypic genus, I prefer to place the present species in the genus *Runcina*. Of described species of *Runcina*, only *R. marshae* Burn, 1966, is similar to *R. macfarlandi* in having a yellow ground color. However, the rachidian teeth of *R. marshae* are not strongly bilobed, as in *R. macfarlandi*. Also the gizzard plates of *R. marshae* are more highly denticulate than in *R. macfarlandi*.

Specimens of runcinids have previously been collected from the coast of California. In MacFarland's original field notes (housed at the California Academy of Sciences), I have located an illustration of a runcinid collected from Pacific Grove on 12 August 1899. The animal is similar in color and shape to the present species. No other details of the anatomy of this animal are known and no specimens have been found in the MacFarland Collection at the California Academy of Sciences. GOSLINER & WILLIAMS in Smith & Carlton, 1975, listed a yellow *Runcina* from Pacific Grove. This record was based on specimens that Peter Glynn collected and Michael Ghiselin identified from Hopkins Marine Station. Attempts to find other material from the Monterey Peninsula have been unsuccessful to date. It is likely, however, that specimens collected from these localities are conspecific with the present species.

Order Nudibranchia

Suborder Doridacea

Family DISCODORIDAE Bergh, 1891

Genus *Baptodoris* Bergh, 1884

Baptodoris mimetica Gosliner, sp. nov.

(Figures 1B, 4-6)

Type material: Holotype, California Academy of Sciences, San Francisco, CASIZ 074575, intertidal zone, Asilomar State Park, Pacific Grove, California, 6 July 1986,



Figure 4

Baptodoris mimetica sp. nov. Scanning electron micrographs of notal structures. A. Surface view of caryophyllidia. B. Cross section of caryophyllidium. C. Cross section of notum.

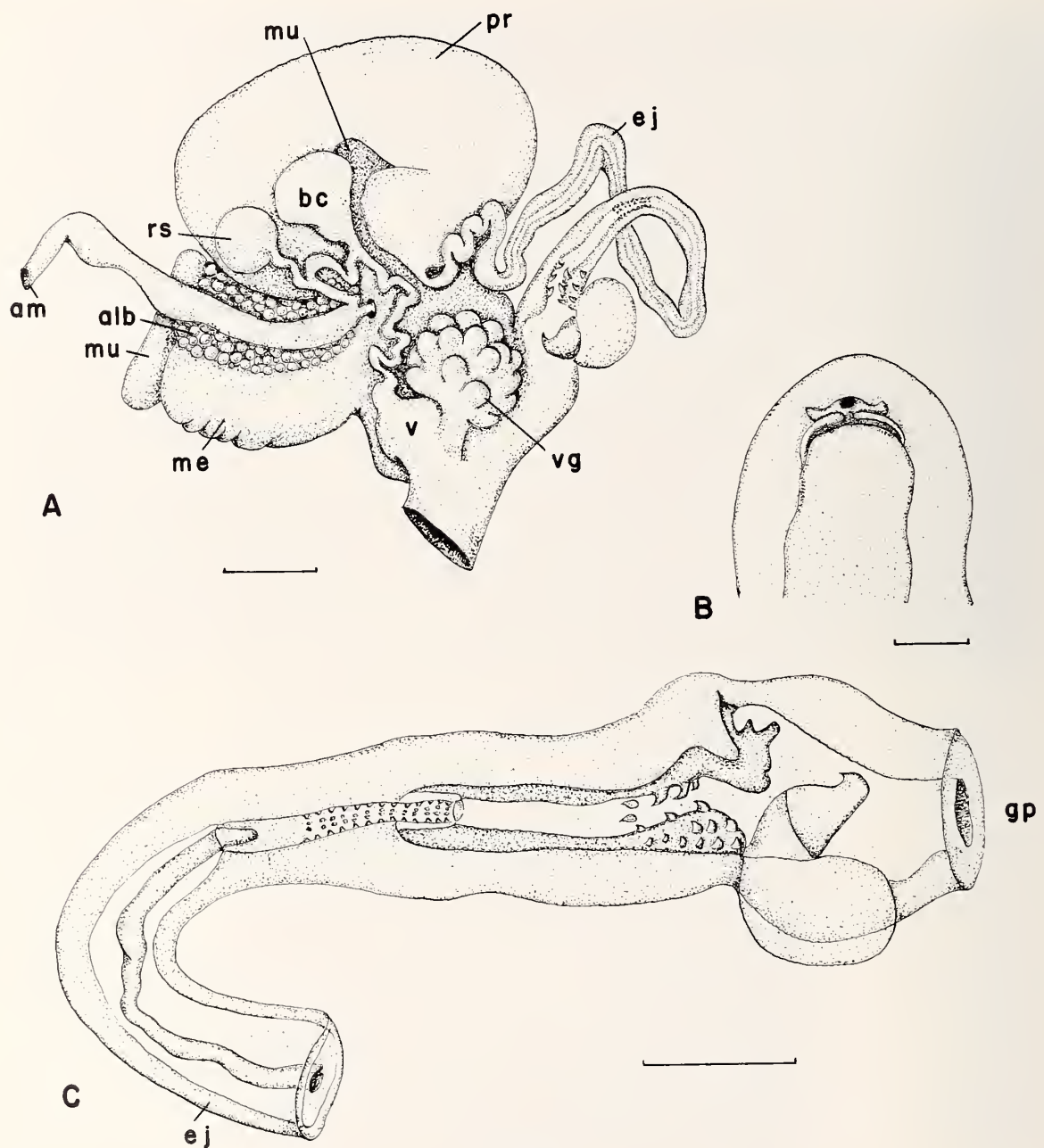


Figure 5

Baptodoris mimetica sp. nov. A. Reproductive system: alb, albumen gland; am, ampulla; bc, bursa copulatrix; ej, ejaculatory portion of vas deferens; me, membrane gland; mu, mucous gland; pr, prostatic portion of vas deferens; rs, receptaculum seminis; v, vagina; vg, vestibular gland; scale = 0.5 mm. B. Ventral view of animal showing head and anterior end of foot: scale = 3 mm. C. Distal end of vas deferens and penis: ej, ejaculatory duct; gp, gonopore; scale = 0.5 mm.

Gary McDonald. Paratypes, two specimens, CASIZ 074576, south storage tank, Long Marine Laboratory, Santa Cruz, California, 5 October 1983, G. McDonald. Paratype, dissected, CASIZ 074577, south storage tank, Long Marine Laboratory, Santa Cruz, California, 5 October 1983, G. McDonald. Paratype, dissected, CASIZ

074578, Long Marine Laboratory, Santa Cruz, California, October 1989, G. McDonald. Paratype, CASIZ 072093, Monastery Beach, Carmel, California, 5 October 1975, Andrea Purdue. Paratype, CASIZ 069142, 6 m depth, Monastery Beach, Carmel California, 6 March 1976, A. K. McDonald. Paratype, CASIZ 072094, Mon-

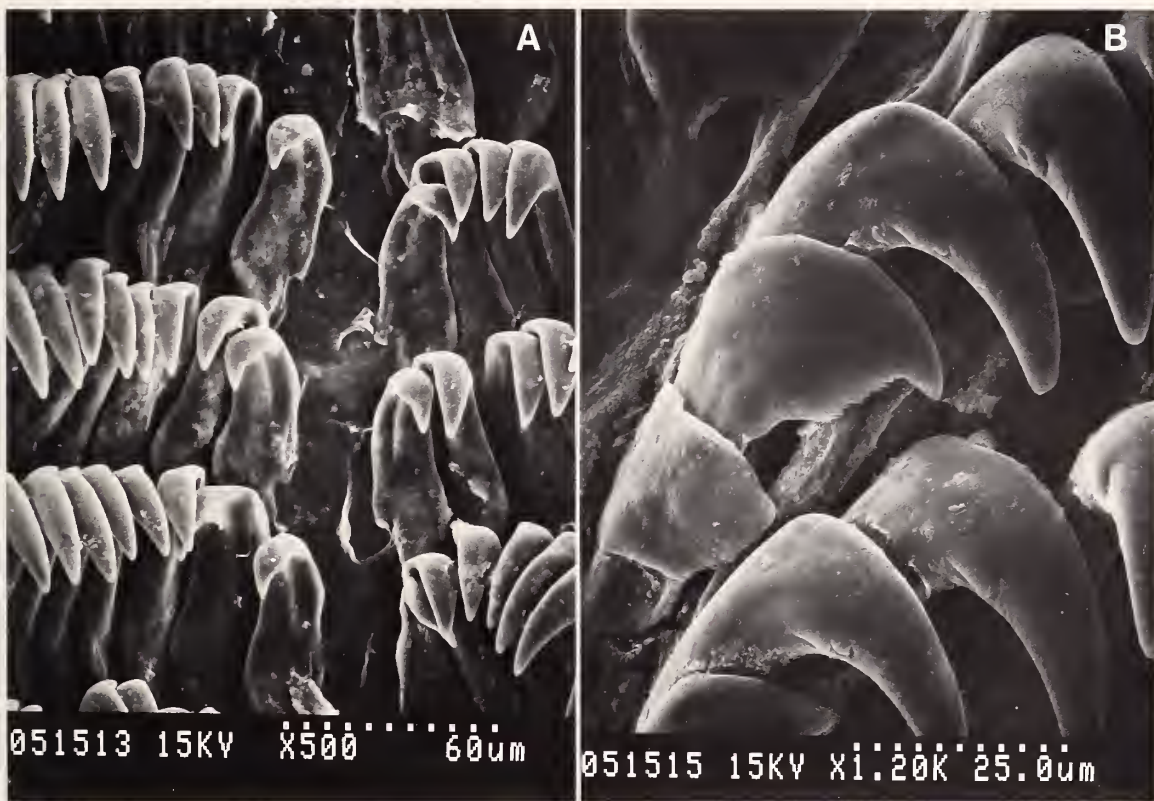


Figure 6

Baptodoris mimetica sp. nov. Scanning electron micrographs of radula. A. Innermost radular teeth. B. Outermost radular teeth.

astery Beach, Carmel, California, 25 November 1970, Ed Stark. Paratype, dissected, CASIZ 074579, Isla San Martín, Baja California, David Behrens.

Distribution: This species has been collected from Santa Cruz, California, to Isla San Martín, off the Pacific coast of Baja California, Mexico.

Etymology: The epithet *mimetica* refers to the striking external similarity between this species and the common sympatric dorid nudibranch *Doriopsilla albopunctata* (Cooper, 1863).

External morphology: The living animals (Figure 1B) reach 25 mm in length. The ground color is bright lemon yellow. Small opaque white spots are uniformly scattered over the dorsal surface of the notum. The rhinophores are uniformly brown. The gills are translucent white.

The notum is finely studded with minute caryophyllidia. When examined under the scanning electron microscope, these caryophyllidia are 30–50 μm in diameter. Each caryophyllidium (Figure 4A) is supported by a ring of 7–12 calcareous spicules. In the center is a mound covered by dense cilia. The structure of the caryophyllidia is very similar to that described by KRESS (1981) and FOALE &

WILLAN (1987) for species of *Rostanga* and *Jorunna*. The supporting spicules of the caryophyllidia penetrate deeply into the notal tissue (Figure 4B). The rigid notum contains a dense mat of calcareous spicules (Figure 4C).

The rhinophores are perfoliate with 14 closely spaced lamellae. The branchial plume consists of 7 or 8 bipinnate gills. The gills are held erectly when fully extended. The anus is situated within the center of the branchial plume. The head (Figure 5B) is well developed, with paired labial tentacles. The foot is broad, and bilabiate anteriorly. The posterior end of the foot is rounded and extends beyond the posterior limit of the notum. The genital aperture is situated between the ventral portion of the notum and the foot, approximately one-third of the body length behind the head.

Buccal mass: The buccal mass is large and muscular. The anterior portion of the mass is lined with a thick labial cuticle, which is devoid of any jaw rodlets. More posteriorly, is the radula, with a formula of $38 \times 51.0 \cdot 51 \cdot$ and $41 \times 52.0 \cdot 52 \cdot$ in two specimens observed. The rachis lacks a rachidian row of teeth. The inner lateral teeth (Figure 6A) are simply hamate. They are devoid of any denticles. The laterals from the middle of the half row are larger

than the inner ones and have a more elongate cusp. The outermost laterals (Figure 6B) are short and flattened, with a finely serrate masticatory border. The two teeth immediately inward from these two (Figure 6C) are typically hamate, but bear 2 or 3 denticles on their outer edge.

Reproductive system (Figure 5A, C): The arrangement of the reproductive organs is triauleic. The ampulla is elongate and slightly curved. At its distal end, the ampulla divides into a short oviduct and the vas deferens.

The oviduct is short and enters the female gland mass between the albumen and membrane glands. The mucous gland is massive with several lobes. It terminates at the nidamental opening, immediately ventral to the common atrium of the vas deferens and vagina. At the junction of the ampulla, vas deferens, and oviduct is the uterine duct. After a short distance, it branches to the duct of the spherical receptaculum seminis. The uterine duct curves and joins the base of the pyriform bursa copulatrix. From this junction the thin, convoluted vagina extends distally. At its distal end it expands into a vaginal atrium, which joins with a large lobate vestibular gland.

The vas deferens expands immediately into the massive prostate. The prostate narrows into a convoluted ejaculatory segment, which gradually widens. The muscular portion of the ejaculatory duct empties into a tubular section with a chitinous lining (Figure 5C). The proximal portion of this segment is lined with four rows of minute chitinous hooks. This area widens into a section without armature. More distally is a segment with four shorter rows of larger spines. Immediately distal to this point the duct widens markedly. On one side of the duct is a swollen muscular pouch, which bears a single large chitinous spine with a curved apex.

Discussion: The generic distinctions within the Discodorididae are the subject of considerable confusion. More than 30 genera have been included within the family by various workers (THIELE, 1931; FRANC, 1968). Many genera are monotypic and are known only from the original descriptions, which are often incomplete. Members of the family appear to be united by several apomorphic features. All species appear to have digitiform labial tentacles, an anteriorly divided foot, and a thick, well-developed prostate. Other features vary within and between genera. The notum may be composed of simple tubercles or complex caryophyllidia. Presence or absence of caryophyllidia may vary within a single genus, such as *Sclerodoris* Eliot, 1904 (RUDMAN, 1978). Jaw rodlets may be present or absent in a single genus, such as *Jorunna* Bergh, 1876 (EV. MARCUS, 1976). Outer radular teeth may be denticulate or simply hamate within a single genus, as in *Halgerda* Bergh, 1880 (RUDMAN, 1978). A vestibular gland and penial spines may be present or absent in species of *Sclerodoris* (KAY & YOUNG, 1969; RUDMAN, 1978). Many of the described genera appear to be paraphyletic or are based solely on plesiomorphic features (e.g., *Discodoris*

Bergh, 1877). Revision of the systematics of the cryptobranch dorids must await detailed evaluation of characters, their polarity and phylogeny. Until this is achieved, placement of taxa within genera must be regarded as tentative.

The present species is placed within the genus *Baptodoris* Bergh, 1884, based on its similarity to the type species, *B. cinnabarina* Bergh, 1884. The genus is characterized by having a firm, finely spiculate notum, digitiform labial tentacles, a labial cuticle without rodlets, and penial armature with numerous hooks. SCHMEKEL (1970) further described the reproductive anatomy of *B. cinnabarina*. This species has numerous rows of spines lining the distal portion of the vas deferens and has a single larger penial spine. It also has an expanded vaginal atrium with an adjacent vestibular gland.

Baptodoris mimetica differs from *B. cinnabarina* in several significant regards. The ground color of the present species is yellow rather than scarlet. The radular teeth of *B. cinnabarina* are all narrow and hamate, without denticles. In *B. mimetica* the hamate teeth are broader and the outer ones are denticulate and serrate. The penial spines of *B. mimetica* are more numerous and complex in their arrangement.

Llera & Ortea in ORTEA *et al.* (1982) described *Baptodoris perezii* from the Canary Islands and reviewed the other members of the genus. Like *B. mimetica*, *B. perezii* is yellow, but has black rather than yellowish spots. *Baptodoris perezii* has unipinnate rather than bipinnate gills. In this species, caryophyllidia are restricted to the margins of the notum rather than being evenly scattered. In *B. perezii*, the radular teeth are simply hamate, without denticles or serrations. This species also lacks a vestibular gland.

Baptodoris fongosa Risbec, 1928, known only from its original description from New Caledonia, is reddish yellow with gray patches. Its outer four teeth per half row are finely serrate, while in *B. mimetica* only the outer two teeth are serrate. A vestibular gland was not described.

Baptodoris tuberculata Bergh, 1888a, described from Thailand, is poorly known. All of its radular teeth are hamate, without denticles, except for some of the outermost teeth, which are bifid. A penial gland is present at the gonopore.

ORTEA, *et al.* (1982) also considered *Aporodoris rubra* Bergh, 1905, as a species of *Baptodoris*. In this species the outer four teeth are finely serrate.

The anatomy of *Baptodoris fongosa*, *B. tuberculata*, and *B. rubra* must be more completely described before they can be adequately compared with other described discodorids. Clearly though, enough is known about these taxa to distinguish them from *B. mimetica*.

Gargamella Bergh, 1894, contains two described and two undescribed species that share most of the features listed above for *Baptodoris cinnabarina* (see ODHNER, 1926; EV. MARCUS, 1959; GOSLINER, 1987). The only significant difference between species of this genus and those included

in *Baptodoris* is that the vestibular duct is present on the vas deferens rather than on the vaginal duct. On this basis, one might seriously question the homology of these structures. Further study is required to verify the location of these vestibular glands and to examine details of their histology and function.

Species of *Platydoris* Bergh, 1877, also have spines lining the vas deferens (KAY & YOUNG, 1969; EDMUNDS, 1971). Their vestibular gland enters the vas deferens, as in *Gargamella*, rather than entering the vagina. Externally, members of *Platydoris* differ from species of both *Baptodoris* and *Gargamella*, as they are dorsoventrally flattened and lack caryophyllidia.

Baptodoris mimetica closely resembles *Doriopsilla albopunctata* (Cooper, 1863) and other conspecific species of porostomes, whose systematic status remains unclear, in its external morphology and coloration. Living animals of the two species can be readily distinguished. *Doriopsilla albopunctata* has a soft fleshy texture, whereas *B. mimetica* is rigid and is finely covered with caryophyllidia. The gills of *D. albopunctata* are more highly pinnate and cover more of the notum when fully extended. The gills of *B. mimetica* are held more erectly than those of *D. albopunctata*. Ventrally, *B. mimetica* has elongate digitiform labial tentacles, whereas in *D. albopunctata* and other porostomes, rudimentary tentacles are present on either side of the mouth.

Suborder Aeolidacea

Family FACELINIDAE Bergh, 1889

Subfamily FAVORININAE Bergh, 1889

Genus *Noumeaella* Risbec, 1937

Noumeaella rubrofasciata Gosliner, sp. nov.

(Figures 1C, 7, 8)

Type material: Holotype, California Academy of Sciences, San Francisco, CASIZ 074580, 20 m depth, S end of Isla San Benito Oeste, Baja California, 17 August 1987, T. M. Gosliner. Paratype, dissected, CASIZ 074581, same date and locality as holotype. Paratype, CASIZ 074582, same date and locality as holotype. Paratype, CASIZ 074583, Isthmus Cove, Santa Catalina Island, California, 10 October 1985, James Morin. Paratype, CASIZ 074027, under rock, 2–4 m depth, near point in front of Hotel Punta Colorada, Punta Colorada, Gulf of California, Baja California Sur, Mexico, 15 November, 1972, Antonio J. Ferreira.

Distribution: This species has been found along the California coast from Santa Barbara Island (Marc Chamberlain, personal communication) and Santa Catalina Island (present study). It has also been found from the Pacific coast of Mexico from Islas San Benitos (present study) and from Punta Colorada, Baja California Sur, in the Gulf of California (present study).

Etymology: The epithet *rubrofasciata* refers to the reddish stripe present on the middorsal portion of the head.

External morphology: The living animals (Figure 1C) reach 8 mm in length. The ground color is translucent white. Most of the dorsal and lateral surfaces of the body are covered with dense opaque white. The base and apex of the rhinophores, the basal one-fourth of the oral tentacles, and the sides and bottom of the foot are the only areas that are translucent white. A red-orange stripe extends middorsally from the anterior limit of the head to the anterior limit of the rhinophores. The base of each cerata is opaque white. Above the base, the cerata are translucent and the brick-red digestive gland is visible. The large cnidosac is deep red-orange.

The body is thin and elongate (Figure 7A). The foot is approximately equal in width to the notum and tapers to an elongate, posterior tail. The rhinophores (Figure 7B) are widest in the middle and taper to an elongate apex. Their posterior surface bears numerous, elongate papillae. The narrow and acutely pointed oral tentacles are about twice as long as the rhinophores. The anterior ends of the foot form elongate tentacles, which are sharply recurved when the animal is actively crawling. The cerata are short and somewhat inflated in appearance. They are widest in their distal third. The cnidosac is large and conical in shape. The cerata are arranged in a series of 5–7 horseshoe-shaped arches on either side of the body. The single precardiac arch contains 6–9 cerata in the four specimens examined. The first postcardiac arch contains 5–7 cerata. The subsequent arches contain fewer cerata posteriorly and are each composed of 1–6 cerata. The anus is cleio-proctic, located on the right side of the body, within the first postcardiac ceratal arch. The nephroproct is located within the interhepatic space. The gonopore is situated below the anterior limb of the anteriormost ceratal arch.

Buccal mass: The buccal mass is short and muscular. A lobate oral gland is present on either side of the buccal mass (Figure 7C). Each gland extends posteriorly for about two-thirds of the length of the buccal mass. Within the mass are the paired chitinous jaws (Figure 7D). The masticatory border of the jaw is of moderate length (Figure 8A) and bears 5 or 6 rows of irregular denticles (Figure 8B). The outermost denticles are irregularly divided into 4 or 5 apices while those of the inner 4 or 5 rows have a simple acute apex.

The radular formula in the one specimen examined was $14 \times 0.1.0$. The radular teeth (Figure 8C, D) are broadest posteriorly. The posterior limbs of the teeth are acutely pointed and evenly arched. The central cups is narrow but wider and more elongate than the adjacent denticles. There are 7–9 elongate, inwardly curved denticles on either side of the central cusp.

Reproductive system (Figure 7E, F): The arrangement of the organs is androdiaulic. The ampulla is thin and

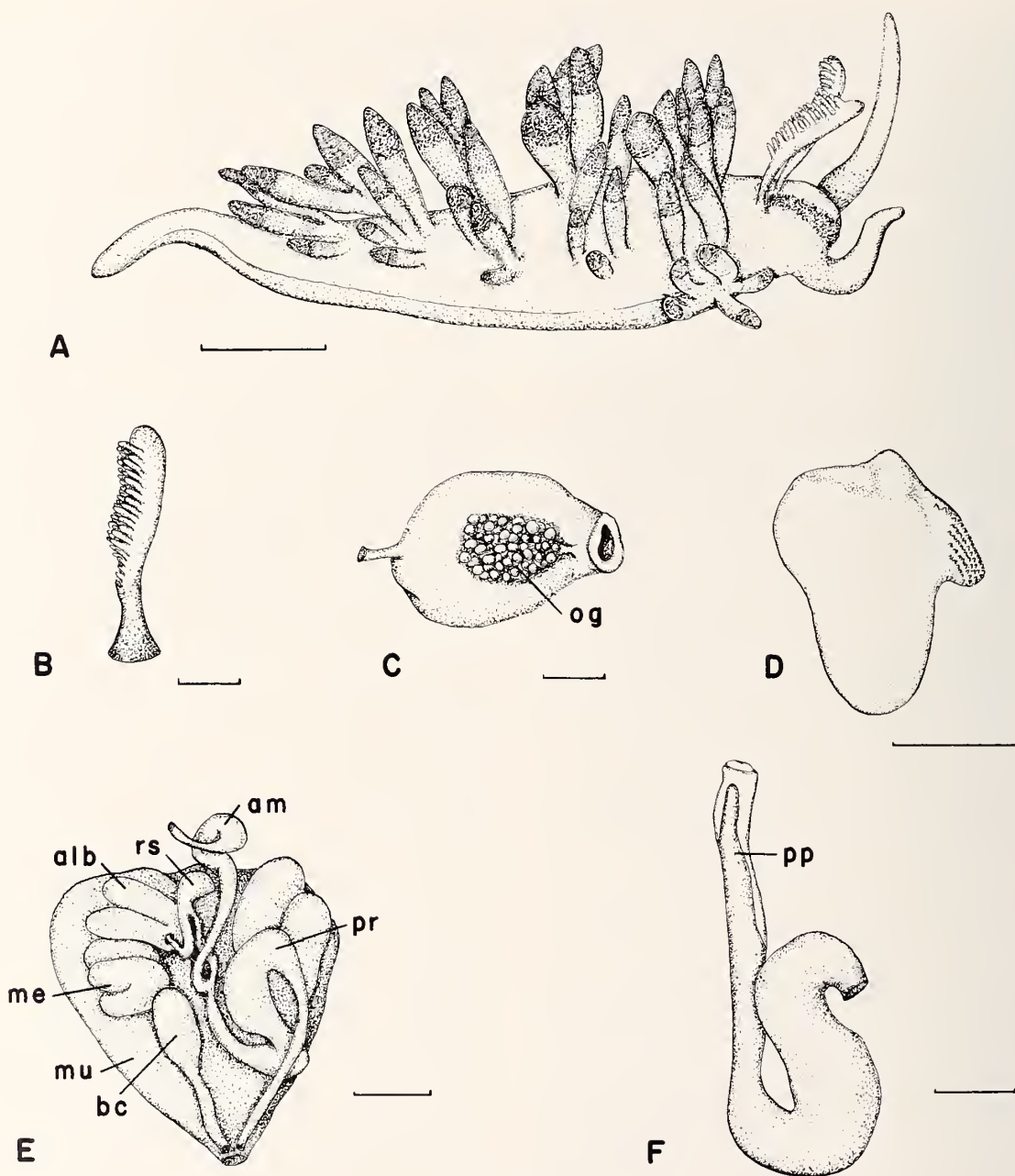


Figure 7

Noumeaella rubrofasciata sp. nov. A. Lateral view of preserved specimen: scale = 1 mm. B. Rhinophore: scale = 0.25 mm. C. Buccal mass: og, oral gland; scale = 0.25 mm. D. Jaw: scale = 0.5 mm. E. Reproductive system: alb, albumen gland; am, ampulla; bc, bursa copulatrix; me, membrane gland; mu, mucous gland; pr, prostatic portion of vas deferens; rs, receptaculum seminis; scale = 0.25 mm. F. Penis: pp, penial papilla; scale = 0.125 mm.

slightly coiled. Distally, the ampulla narrows and bifurcates into the oviduct and vas deferens. The oviduct is narrow and expands into a partially serial pyriform receptaculum seminis. The oviduct again narrows immediately before its entrance into the bilobed albumen gland.

The lobate membrane gland is adjacent to the albumen gland. The mucous gland is the largest portion of the reproductive system and consists of three major lobes. The mucous gland terminates at the common gonopore. The elongate duct of the thin-walled bursa copulatrix joins the

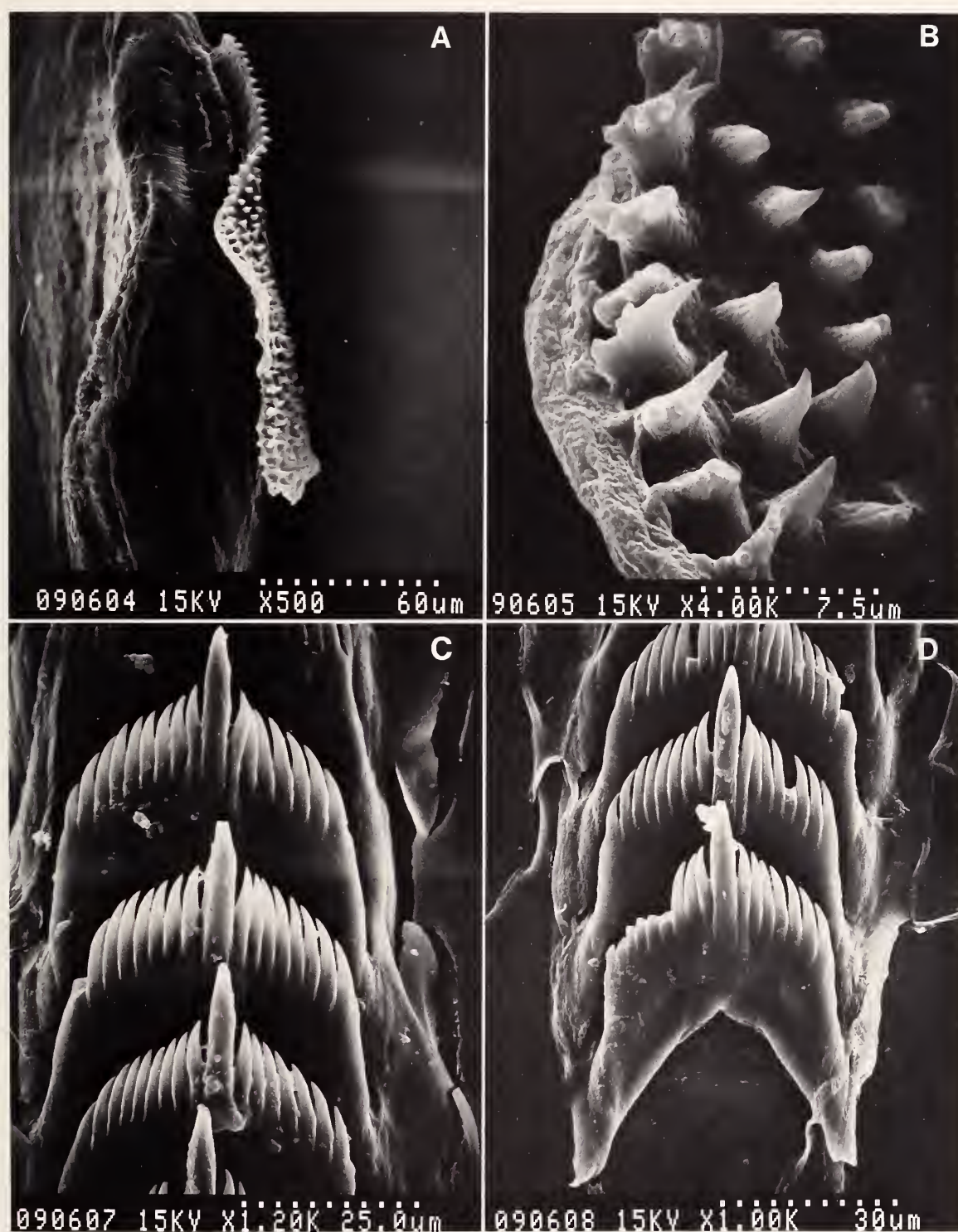


Figure 8

Noumeaella rubrofasciata sp. nov. Scanning electron micrographs. A. Masticatory border. B. Denticles of masticatory border. C and D. Radular teeth.

mucous gland near the gonopore. The vas deferens gradually expands into a curved prostatic portion, which again gradually narrows into the simple, elongate penial papilla. The papilla lacks any armature or glands.

Discussion: The present species is clearly placed within the Facelinidae and included with the Favorininae on the basis of its cleioproct anus, cerata all included in arches, and cuspidate radular teeth. Only members of three genera of favorinids—*Noumeaella* Risbec, 1937, *Palisa* Edmunds, 1964 and *Jason* Miller, 1974—include species with papillate rhinophores.

WILLAN (1987) discussed character polarities of primitive and derived features within the Facelinidae. On the basis of this discussion and the incorporation of other features not included by Willan, it is clear that *Noumeaella rubrofasciata* differs markedly from other facelinids with papillate rhinophores. *Moridilla brockii* Bergh, 1888b, differs from the present species in that all of the cerata are arranged in linear rows rather than in arches. *Jason mirabilis* Miller, 1974, has a vestigial radula consisting of only five teeth, some cerata arranged in arches with two rather than one row of cerata, and a penial papilla with apical glands. Members of the genera *Noumeaella* Risbec, 1937, and *Palisa* Edmunds, 1964, are most similar to the present species. *Noumeaella* includes four species (*N. curiosa* Risbec, 1937, *N. rehderi* Er. Marcus, 1965, *N. isa* Ev. Marcus & Er. Marcus, 1970, *N. africana* Edmunds, 1970), and all are known only from the Indo-Pacific tropics. *Palisa* contains only a single species, *P. kristenseni* (Ev. Marcus & Er. Marcus, 1963), which is considered a senior synonym of *P. papillata* Edmunds, 1964 (EDMUNDS & JUST, 1983). All of these species share several derived features: papillate rhinophores, cerata arranged in arches with only a single row, and a well-developed prostatic vas deferens. The only difference between *Noumeaella* and *Palisa* is that *P. kristenseni* has more precardiac cerata and an unarmed penis. Because both of these features of *Palisa* are plesiomorphic, there are no autapomorphies to distinguish it from *Noumeaella*. On this basis, and by the rule of priority, *Palisa* is considered a junior synonym of *Noumeaella*.

Noumeaella rubrofasciata can be readily separated from the other described species of the genus by its unique color pattern with red pigment and by several aspects of its internal anatomy. In *N. rubrofasciata* there are two plesiomorphic features not found in other members of the genus: the masticatory border of the jaw bears several rows of denticles, and a distinct distal bursa copulatrix is present adjacent to the gonopore. EDMUNDS (1970: fig. 20B) illustrated a structure called a bursa copulatrix in *N. africana*. However, this structure is contiguous with the serial receptaculum seminis along the oviduct, prior to its entrance into the female gland mass. It is, therefore, not considered to be homologous with a bursa situated at the gonopore, which is characteristic of *N. rubrofasciata* and most other opisthobranchs. *Noumeaella rubrofasciata* has

one apomorphic feature not known in other members of the genus: the gonopore is situated anterior to the precardiac ceratal arch, rather than posterior to it, as in the remaining members of the genus. The radular teeth of *N. rubrofasciata* are more similar to those of *N. africana* and *N. kristenseni*, where the lateral denticles are deeply incised.

Family FACELINIDAE

Anetarca Gosliner, gen. nov.

Diagnosis: Body with broad foot. Rhinophores smooth. Foot corners tentacular. Precardiac cerata arranged in arch containing a single row of cerata. Postcardiac cerata arranged in simple rows. Anus cleioproct, situated between first two postcardiac ceratal rows. Nephroproct situated within interhepatic space. Gonopore ventral to precardiac ceratal arch. Salivary glands simple. Oral glands dorsal. Masticatory border of jaws smooth. Radular teeth with numerous lateral denticles and prominent central cusp. Reproductive system androdialuc with semiserial receptaculum seminis. Bursa copulatrix absent. Penis with posteriorly directed, subterminal spine.

Type species: *Anetarca armata* Gosliner, sp. nov.

Etymology: *Anetarca* is derived from the reversal of the letters forming the genus *Cratena* Bergh, 1864, to which the new genus appears to be allied. The letter "a" was added to the end of the name for euphony. BURN (1969) described *Sclerodoris tarka* based on the Australian aboriginal word *tark*, for a spear. In the present genus, the *tarc* portion of the name also refers to apical penial spine.

Anetarca armata Gosliner, sp. nov.

(Figures 1D, 9–11)

Type material: Holotype, California Academy of Sciences, San Francisco, CASIZ 074067, intertidal zone, S of Punta Asuncion, Baja California Sur, 2 July 1984, Robert Van Syoc. Paratype, CASIZ 074584, same date and locality as holotype. Paratype, dissected, CASIZ 074585, same date and locality as holotype.

Distribution: This species is known only from the type locality along the northern Pacific coast of Baja California Sur.

Etymology: The specific epithet, *armata*, refers to the presence of a posteriorly directed penial spine, which distinguishes this species.

External morphology: The living animals (Figures 1D, 9A) reach 14 mm in length. The general body color is translucent reddish orange. Almost the entire body surface is mottled by patches of opaque cream-white. The size and density of the patches are extremely variable within a single individual. The rhinophores are largely devoid of opaque patches and are a deeper orange than the rest of

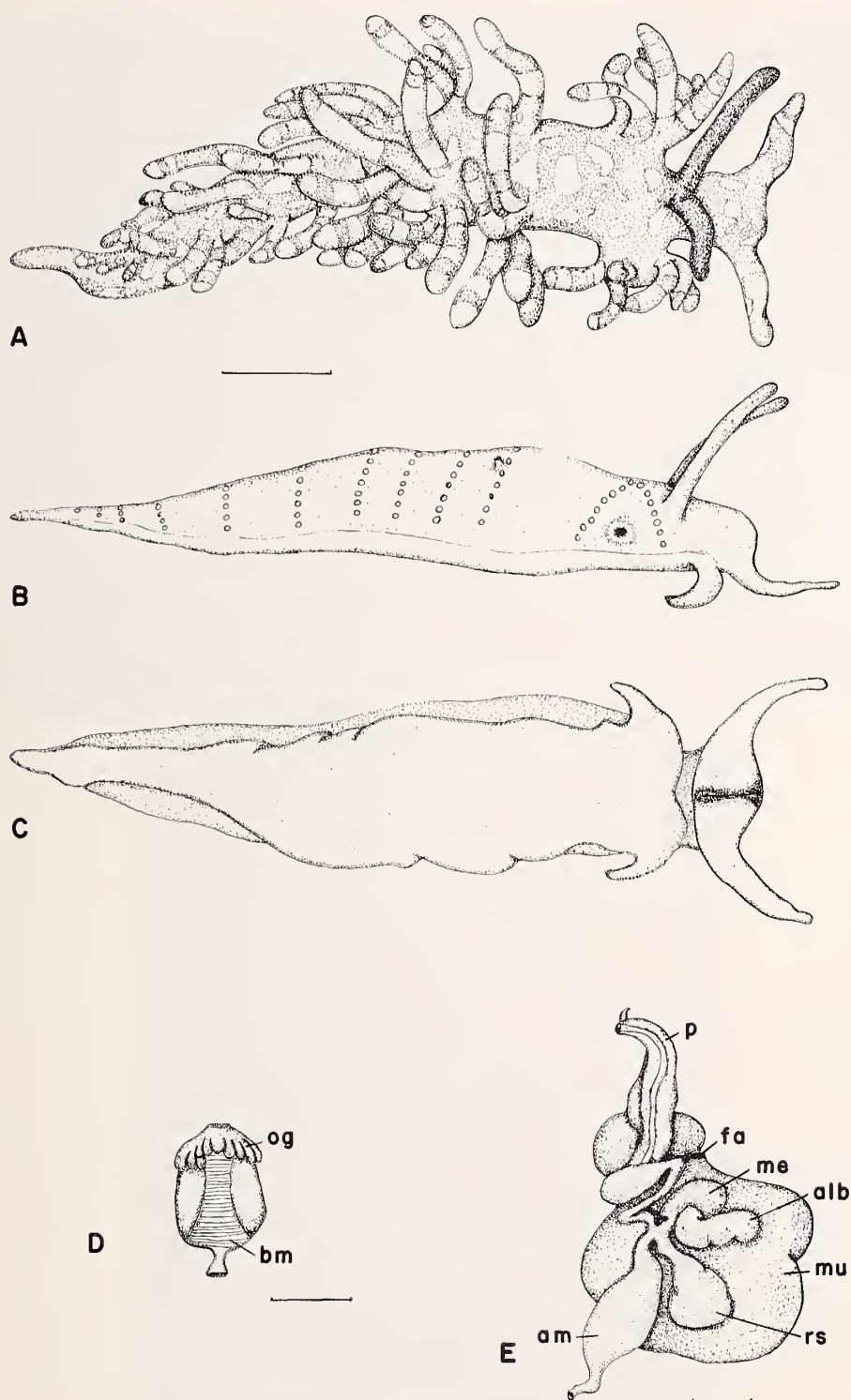


Figure 9

Anetarca armata gen. et sp. nov. A. Dorsal view of living animal: scale = 2 mm. B. Lateral view of preserved animal showing arrangement of cerata: scale = 2 mm. C. Ventral view of head and foot: scale = 2 mm. D. Buccal mass: bm, buccal mass; og, oral gland; scale = 0.5 mm. E. Reproductive system: alb, albumen gland; am, ampulla; fa, female aperture; me, membrane gland; mu, mucous gland; p, penis; rs, receptaculum seminis; scale = 0.5 mm.



Figure 10

Anetarca armata gen. et sp. nov. Scanning electron micrographs. A. Jaw. B. Older radular teeth. C. Newer radular teeth.

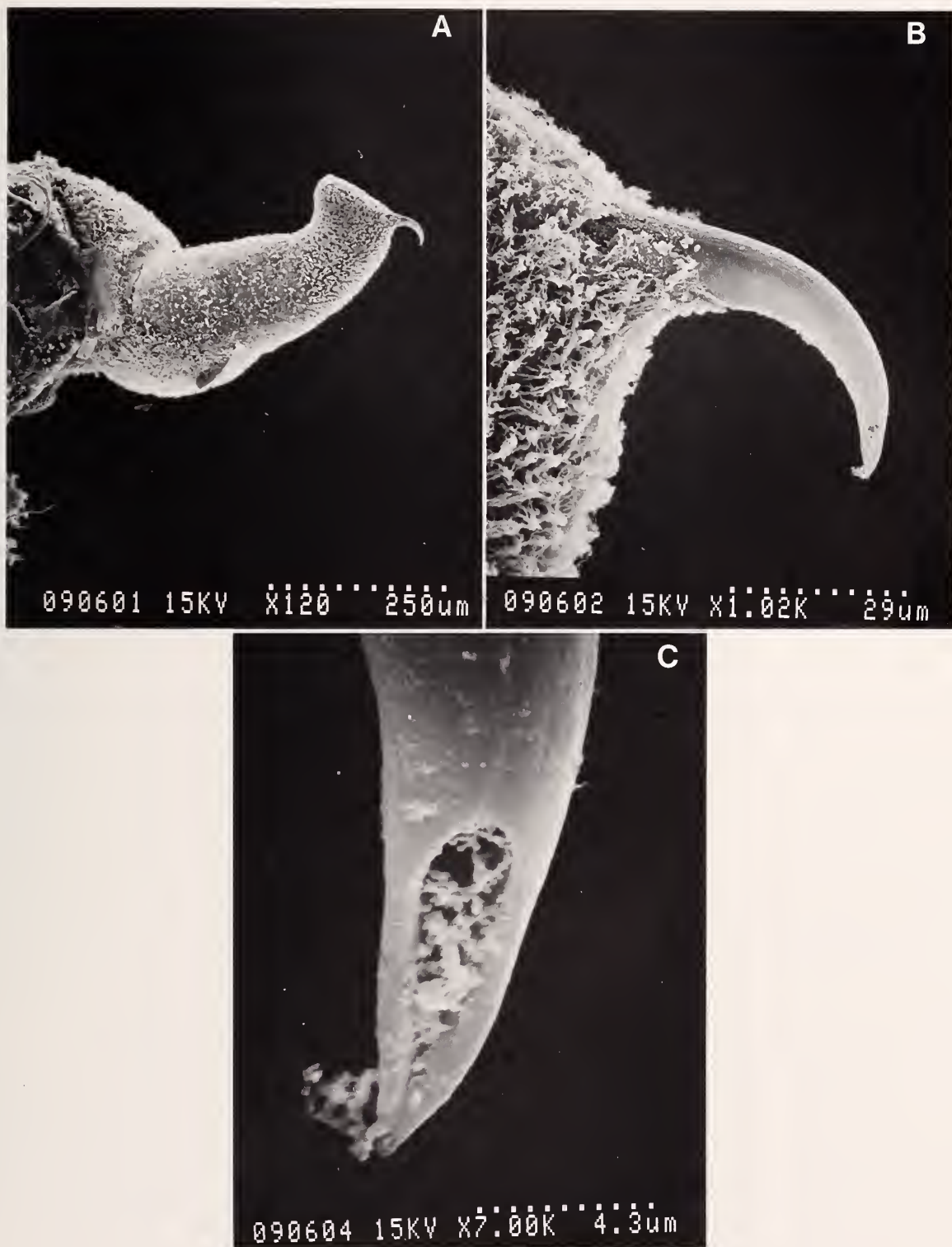


Figure 11

Anetarca armata gen. et sp. nov. Scanning electron micrographs. A. Penis. B. Penial spine. C. Apex of penial spine.

the body. Opaque pigment is present on the head, the oral tentacles, and as irregular transverse bands on the cerata.

The head, foot, and notum are broad, giving the animal a robust appearance. The smooth and elongate rhinophores are broadest basally and taper to a narrow apex. The oral tentacles are shorter than the rhinophores and are relatively stout. The foot corners (Figure 9B) are elongate and tentacular. The ventral portion of the head is deeply cleft and bilabiate (Figure 9C). The cerata are curved and are cylindrical throughout most of their length, but taper to an acute apex. The precardiac cerata are arranged in a single horseshoe-shaped arch that contains only a single row of cerata (Figure 9B). The postcardiac cerata are arranged in a series of 9 or 10 linear rows. The ceratal formula in one specimen is: I-15, II-7; III-7, IV-7, V-7, VI-6, VII-5, VIII-4, IX-3, X-2, XI-1. The gonopore is situated within the arch of the precardiac cerata. The anus is cleioproctic, situated posterior to the first postcardiac ceratal row. The nephroproct is situated within the interhepatic space.

Buccal mass: The buccal mass is short and muscular. A series of lobed oral glands is present on the dorsal surface of the buccal mass (Figure 9D). The jaws (Figure 10A) are broad with a moderately long masticatory border. The border is smooth, without any evidence of denticulation. The radular formula is $13 \times 0.1.0.$ in one specimen examined. The teeth are narrow and broadly arched. The central cusp is broad and elongate. On either side of the cusp are numerous elongate denticles. Older teeth (Figure 10B) may have as few as 8 denticles on either side of the cusp, while newer ones (Figure 10C) may have as many as 11 denticles.

Reproductive system: The arrangement of organs is androdiaulic (Figure 9E). The narrow preampullary duct expands into a curved, saccate ampulla that narrows and divides into a short oviduct and a narrower vas deferens. The oviduct is joined by the thick duct of the semiserial, pyriform receptaculum seminis. Slightly distal to this junction the oviduct enters the female gland mass between the albumen and membrane glands. These two glands are small compared to the lobate mucous gland. The mucous gland terminates at the female gonopore. The vas deferens is narrow proximally and expands into the large penis. There does not appear to be a distinct prostatic region of the vas deferens. The penis curves and enters the penial sac. Within its central portion the narrow penial duct is visible. The penial papilla is curved at its distal apex. At this point the penial duct emerges from the papilla. Near the distal end of the papilla, a chitinous spine is visible (Figure 11A). The spine is sharply curved away from the tip of the penial papilla (Figure 11B). The tip of the penial stylet bears an elongate opening at its apex (Figure 11C), which appears similar to the tip of a hypodermic needle. How the stylet functions is uncertain because it does not appear to be in direct contact with the penial duct.

Discussion: The systematic relationships of the Facelinidae have been reviewed and discussed extensively in recent years (MILLER, 1974; GOSLINER, 1980; EDMUNDS & JUST, 1983; GOSLINER & BEHRENS, 1986; WILLAN, 1987). The family has been divided into subfamilies, largely on the basis of differences in ceratal arrangement (ER. MARCUS, 1958; MILLER, 1974). EDMUNDS (1970) suggested that ceratal arrangement has evolved in a polyphyletic fashion within the family, and GOSLINER (1980) has supported this view.

Since then, RUDMAN (1981) studied the clearly monophyletic facelinid genus *Phyllodesmium*. In this genus, monophyly is highly probable, given the several synapomorphies that unite the species, including absence of cnidosacs, flattened cerata that readily autotomize, and a specialized diet of alcyonarians. RUDMAN (1981: fig. 27) depicted the ceratal arrangement in the various species he studied. The genus *Phyllodesmium* includes species that have cerata contained in arches with one or more rows of cerata within the arches. There are also several species that have only a preanal arch, followed by postanal linear rows, as in the genus *Cratena* Bergh, 1864. Because members of this single genus exhibit most of the ceratal patterns known for members of the family, there remains no question that the ceratal patterns have evolved polyphyletically.

I agree with WILLAN's (1987) hypothesis that, within the Facelinidae, having all cerata arranged in linear rows represents the plesiomorphic state, and that having cerata arranged in arches represents a derivation from the primitive condition. Whether or not evolution of arches from rows occurred only once in the family remains unresolved. Clearly, arches have arisen from rows on at least one other occasion in the Aeolidiidae (GOSLINER, 1985). I would also suggest that, for species of facelinids with arches, those arches with more than one row of cerata are plesiomorphic and those with a single row of cerata are apomorphic. This is consistent with the general trend within aeolids to reduce ceratal numbers. Also apparent in the Facelinidae has been a reduction of postanal ceratal arches to form secondarily derived linear rows, as has occurred independently in some species of *Phyllodesmium* and in *Cratena*. These secondarily derived rows differ from the plesiomorphic arrangement in that single rows are well separated from each other rather than forming clusters of dense rows.

This ceratal arrangement, with a preanal arch and single postanal rows, is also found in *Anetarca*. *Anetarca* lacks all of the above-mentioned synapomorphies present in species of *Phyllodesmium*. Species of *Cratena* are elongate, slender aeolids, whereas *Anetarca armata* is stockier. All described species of *Cratena* have a large penial gland and lack a penial stylet. No penial gland is present in *A. armata*.

Several other genera of facelinids possess a single penial stylet (MILLER, 1974). In *Emarcusia* Roller, 1972, most species of *Noumeaella* Risbec, 1937, and one species of *Favorinus* Gray, 1850, the penis bears a straight, hollow

penial stylet. The penis of *Emarcusia* also bears an accessory appendage. In species of *Phidiana* Gray, 1850, *Godiva* Macnae, 1954, and all but two species of *Herviella* Baba, 1949 (BURN, 1967; RUDMAN, 1980), there is a curved hook at the apex of the penis. *Phidiana* s.s. contains species with numerous ceratal rows per cluster, rounded foot corners, and the anus situated in the posterior half of the body. *Godiva* contains species with all cerata arranged in arches, with more than one row of cerata per arch. *Herviella* contains species with oblique rows of cerata that represent the retention of the anterior limb of a ceratal arch (Miller, 1974). Species in this genus also have rounded foot corners. In all these taxa, the penial hook is situated at the end of the efferent duct. The spine curves inwardly, toward the penial apex. In contrast, the penial hook found in *Anetarca* is subterminal and curves in the opposite direction. On the basis of its unique structure, I hypothesize that the penial hook of *Anetarca* has evolved independently from other chitinous hooks found in other facelinids. On this basis, *Anetarca* cannot be readily accommodated into any existing genus and is considered to be distinct from all other described facelinids.

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